OECD Productivity Database:
Calculation of Multi-factor productivity growth

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The following methodology has been applied for the computation of multi-factor productivity (MFP) measures:

1) Rates of change of output

Output (Q) is measured as GDP at constant prices for the entire economy (main source: OECD Annual National Accounts). Year-to-year changes are computed as logarithmic differences: $\ln(\frac{Q_t}{Q_{t-1}})$

2) Rates of change of labour input

Labour input (L) is measured as total hours actually worked in the entire economy. Data on total hours has been specifically developed for the present purpose. See documentation [LINK] for details. Year-to-year changes are computed as logarithmic differences: $\ln(\frac{L_t}{L_{t-1}})$.

3) Rates of change of capital input

Capital input (S) is measured as the volume of capital services, assumed to be in a fixed proportion to the productive capital stock. See documentation [STATISTICS WORKING PAPER 2003/6 Schreyer/Bignon/Dupont] for a more extensive explanation and for details of the computation of capital services. Sources for the investment series by type of asset underlying the capital services series: national statistical offices[1] and *Groningen Growth and Development Centre Total Economy Growth Accounting Database*[2] (http://www.ggdc.net).

Capital services are computed for seven different types of assets ($S_t^i \quad i = 1,2,...7$) and aggregated to an overall rate of change of capital services by means of a Törnqvist index:

$$(1) \qquad \ln\left(\frac{S_t}{S_{t-1}}\right) = \sum_{i=1}^{7} \tfrac{1}{2}\left(v_t^i + v_{t-1}^i\right)\ln\left(\frac{S_t^i}{S_{t-1}^i}\right) \text{ with } v_t^i \equiv \frac{u_t^i S_t^i}{\sum_{i=1}^{7} u_t^i S_t^i}$$

where v_t^i is the share of each asset in the total value of capital services $\sum_{i=1}^{7} u_t^i S_t^i$. In this expression, the value of capital services for each asset is measured by $u_t^i S_t^i$ where u_t^i is the user cost price per unit of capital services and S_t^i is the quantity of capital services in year t.

4) Cost shares of inputs

[1] For the Australia, Canada, France, Japan, Italy, Germany, United States.

[2] For Austria, Belgium, Denmark, Finland, Greece, Ireland, Netherlands, Portugal, Spain, Sweden, United Kingdom.

The total cost of inputs is the sum of the remuneration for labour input and the remuneration for capital services. Remuneration for labour input has been computed as the average remuneration per employee multiplied by the total number of persons employed. This adjustment was necessary to correct for self-employed persons whose income is not part of the compensation of employees as registered in the national accounts. Source for data on compensation of employees and for the number of employees as well as the number of self employed: OECD Annual National Accounts.

$$w_t L_t = \left(\frac{COMP_t}{EE_t} \right) E_t$$

where

$w_t L_t$: remuneration for labour input in period t

$COMP_t$: compensation of employees in period t

EE_t: number of employees in period t

E_t: total number employed (employees plus self-employed) in period t.

Total cost of inputs is then given by:

$C_t = w_t L_t + \sum_{i=1}^{6} u_t^i S_t^i$ and the corresponding cost shares are

$s_t^L \equiv \frac{w_t L_t}{C_t}$ for labour input and

$s_t^S \equiv \frac{\sum_{i=1}^{6} u_t^i S_t^i}{C_t}$ for capital input.

5) Total inputs

The rate of change of total inputs is a weighted average of the rate of change of labour and capital input with the respective cost shares as weights. Aggregation is by way of a Törnqvist index number formula:

$$\ln\left(\frac{X_t}{X_{t-1}} \right) = \tfrac{1}{2}\left(s_t^L + s_{t-1}^L\right) \ln\left(\frac{L_t}{L_{t-1}} \right) + \tfrac{1}{2}\left(s_t^S + s_{t-1}^S\right) \ln\left(\frac{S_t}{S_{t-1}} \right)$$

6) Multi-factor productivity

Multi-factor productivity is measured as the difference between output and input change, or as 'apparent multi-factor productivity' (see document [DOCUMENT 'Measuring productivity when rates of return are exogenous']):

$$\ln\left(\frac{MFP_t}{MFP_{t-1}} \right) = \ln\left(\frac{Q_t}{Q_{t-1}} \right) - \ln\left(\frac{X_t}{X_{t-1}} \right).$$